The definition and policy relevance of monetary aggregates in the Netherlands : an inquiry into the measurement of monetary services

Chapter 8

SUMMARY AND CONCLUSIONS

8.1 Summary and evaluation

This thesis takes the currently widely accepted view that money matters as a starting point. More specifically, it has become generally recognised in modern macroeconomics that money supply shocks are important determinants of business cycle fluctuations and that excessive money growth leads to inflation in the intermediate term. This explains why central banks in many industrialised economies have, since the 1970s, adhered to a policy of targeting the growth rates of monetary aggregates to achieve their ultimate policy objective of price stability. Instabilities in the demand for money during the 1970s and 1980s, however, have led many central banks to abandon this policy in the past few years. Monetary policy is now frequently implemented through manipulation of short-term interest rates and via direct inflation targeting.

With an application to the case of the Netherlands, this thesis analyses whether these observed instabilities in the demand for the traditional monetary aggregates have been caused by measurement errors as to what comprises money. An important source of measurement error may be the substitutability between the components of monetary aggregates and other liquid financial assets. This substitution affects the appropriate definition of money and, additionally, the (stability of the) demand for monetary aggregates. Consequently, the usefulness of monetary aggregates as indicators for monetary policy is also influenced. Such measurement errors may be reflected in the traditional simple-sum monetary aggregates, because these assume that their component assets are perfect substitutes and that there is no substitution at all with financial assets outside the aggregates. These conditions are unlikely to be met in practice, since a whole spectrum of financial assets with different characteristics is available to the public nowadays.

The importance of measurement error for instabilities in the demand for these simple-sum aggregates is investigated along two lines. First, this study examines how a theoretically correct definition of the flow of monetary services should be constructed and whether the theoretical conditions for simple-sum aggregation in the Netherlands are fulfilled. The second objective of the thesis is to analyse whether a theoretically correct measure of money that takes into account the potential imperfect substitutability between financial assets is an appropriate indicator of the state of the economy in the Netherlands. The relative usefulness of simple-sum and weighted monetary aggregates as monetary policy indicators, and in particular as indicators of

inflation, may be interpreted as an indication of the relative stability of demand for the respective money measures.

The thesis shows that a correct measure of the flow of monetary services in an economy (which is what monetary aggregates should deal with) should be founded on microeconomic consumer demand theory and on index number theory. Chapter 2 provides a survey of the international empirical literature on the measurement of monetary services. It appears that many monetary aggregates, which have traditionally been used for policy purposes, are not in accordance with theoretical considerations. Furthermore, the components of such aggregates are imperfect substitutes, or even complements, indicating that simple-sum aggregation over these components is inappropriate. The evidence for different countries shows that theoretically correct (weighted) monetary aggregates, however, do not clearly outperform their simple-sum equivalents as inflation and real growth indicators.

In chapter 3 the underlying microeconomic theory for consistent aggregation is explained in more detail. It is shown that optimizing behaviour of economic agents determines whether an aggregate defined over a number of goods or assets is considered as an elementary good. An aggregate is assumed to behave as an elementary good if preferences over its components are independent of goods or assets which are excluded from the aggregate. The necessary condition for consistent aggregation over a group of goods or assets is called weak separability. Weak separability should be fulfilled before small-scale economic models can be applied in empirical analysis. With respect to monetary theory it implies that separate analysis of the monetary sector can only be justified if it appears weakly separable from the real sector. Using Varian's (1982 and 1983) nonparametric test this first type of separability is confirmed for most monetary groups analysed with annual Dutch data. The test is adjusted in order to correct for the effect of budget increases over time. Without this adjustment, the results of weak separability tests may seriously be affected by this income effect dominating pure substitution effects between the aggregates' components. In general, the adjusted test shows more violations of the weak separability conditions than the unadjusted test.

My objective in chapter 3 is to define monetary aggregates in such a way that they are weakly separable from other financial assets. It appears that violations of weak separability are frequently found when a long period of time is analysed. This suggests that the violations are mainly caused by inconsistency with demand theory for observations which are far apart in time, and that, essentially, only the transitivity axiom of consumer preferences is violated. An explanation for these violations may be found in the early 1970s when adjustment costs of asset portfolios were relatively high compared with the 1980s. Moreover, the necessary conditions for weak separability of various monetary aggregates are mostly violated in less than 5 % of the total number of combinations tested. The relatively small number of violations suggests that the rejections of weak separability are not significant.

In general, taking into account the 5 % decision rule, the tests indicate that the Dutch M1 and the harmonised M3 aggregate, and an aggregate defined over M1 plus time deposits and savings may be considered weakly separable from other financial assets. The M2 aggregate, however, reveals more violations of demand theory than

the other three definitions of money, especially when asset stocks are adjusted for budget increases. After 1981 M2 also appears weakly separable from other financial assets. According to the outcomes of the nonparametric weak separability tests, there are still some doubts whether the M2 aggregate may be considered an elementary good. Similar results as with a portfolio for the whole economy are obtained for asset stocks held by households only. Again, M2 reveals many violations of demand theory.

After the admissible components of monetary aggregates have been determined in chapter 3, chapter 4 provides the microeconomic and index number theory for the determination of the correct aggregation method over these components. Monetary aggregates should measure liquidity (or the flow of monetary services) in an economy, since liquidity is an important determinant of total spending and inflation. It is argued that a proper monetary aggregate should, therefore, take into account the different degrees of liquidity of financial assets, which are comparable to durable goods. The usually applied simple-sum aggregates measure the stock of money instead of the flow of monetary services, while all components of these aggregates are treated as perfect substitutes with the same degree of moneyness. A good proxy for the degree of liquidity of financial assets is the interest foregone when people hold their wealth in liquid form. Consequently, theoretically well-defined monetary aggregates can be calculated as weighted monetary aggregates and not as simple-sum aggregates. Theoretical research shows that such a weighted aggregate is the Divisia index, which is founded in microeconomic optimization decisions. The Divisia aggregate approximates the unknown utility (or aggregator) function of economic agents over a whole spectrum of financial assets. Chapter 4 also presents some preliminary evidence of the differences between simple-sum monetary aggregates and their Divisia counterparts constructed for the Netherlands. Mostly, the Divisia aggregates' growth rates have been lower than the rates for the simple-sum aggregates, but the differences are only marginal. Velocity of Divisia M2, Divisia M3 and sum M3 is relatively closely related to the respective opportunity cost measures. This may be an indication that Divisia aggregates internalise pure substitution effects between their component assets rather well.

Chapter 5 uses price and quantity data for the main components (currency, demand deposits, short-term time deposits and savings) of the Dutch harmonised M3 aggregate to test whether these financial assets possess the same degree of moneyness and are, as a result, perfect substitutes. Stated differently, chapter 5 tests whether simple-sum aggregation over the main M3 component assets is allowed. Three different functional forms that can approximate the public's unknown utility (or aggregator) function over financial assets are used to derive systems of asset demand equations and estimate elasticities of substitution between the M3 components. The static and the dynamic Fourier function are global approximations, which allow the computation of time series of own- and cross-substitution elasticities between these financial assets. The translog utility specification, however, only provides a local approximation to the unknown utility function and allows estimates of average elasticities. Since portfolio behaviour of the household sector differs substantially from the business sector's behaviour, the analysis is performed for the economy as a whole and for the

two sectors separately. An innovation to the existing literature is that our normalisation of financial assets' user costs leads to a homogeneous system of demand equations.

Overall, the estimated elasticities are as expected by demand theory. Substitution relationships between the M3 component assets dominate, both at the aggregate and the sectoral level. The sectoral analysis shows that only currency and time deposits (in the business sector) and currency and savings (in the household sector) are complementary assets. These complementarity results are obtained with all three functional forms: the only exception is the translog specification, which shows that currency and savings are substitutes. In general, however, the translog utility function does not give reasonable estimates of the magnitudes of the substitution elasticities. The contra-intuitive results provided by the translog demand system may be caused by the local approximation of the consumer's unknown utility function and the imposition of curvature restrictions, which affects the flexibility of the approximation.

The magnitudes and time-paths of the estimated elasticities are different for the static and the dynamic Fourier function, but the conclusions about substitutability or complementarity between assets are not affected by the choice of the global approximation to the utility function. Overall, the time series evidence obtained with the two Fourier specifications reveals that the estimated elasticities are relatively stable over the period 1972-1993. In the business sector, however, the elasticities show down- or upward trends after 1988 (in the dynamic Fourier version). These trends may be explained by observed changes in the expenditure shares of the assets in the business sector's portfolio in this time period. The results indicate that the dynamic Fourier function gives a good view of portfolio behaviour in the business sector, whereas the static Fourier estimates household behaviour in a satisfying way.

The hypothesis of perfect substitution within one simple sum aggregate, be it M1 or harmonised M3, clearly has to be rejected. Consequently, the analysis into the degree of substitution between the main components of harmonised M3 shows that simple-sum aggregates in the Netherlands do not measure the flow of monetary services appropriately. Since Divisia monetary aggregates are more suitable to incorporate differences in the degree of moneyness of various financial assets, breaks in income velocity may be avoided with Divisia money measures. The stability of the estimated elasticities, however, may explain why Dutch simple-sum and Divisia monetary aggregates show a similar behaviour over time. This stability indicates that changes in relative prices between the M3 components have not been responsible for instabilities in money demand in the Netherlands. Portfolio behaviour in the business sector seems to have been the main source of money demand instability in the Netherlands. On the other hand, the differences between the two aggregation methods may be more pronounced when monetary aggregates are calculated at the sectoral level. Generally, our findings throw additional doubt on the use of simple-sum aggregates and call for a disaggregated monetary analysis.

The results so far show that simple-sum aggregates are unable to measure the flow of monetary services in the Netherlands properly. In theory it is clear, by now, that weighted aggregates are to be preferred in this respect, since these can better incorporate the imperfect substitution between the different financial assets. The

above findings do not imply, however, that weighted (Divisia) aggregates are also better indicators for monetary policy in general, and for inflation in particular. To answer this question, chapter 6 compares the relative performance of simple-sum and Divisia monetary aggregates as indicators of inflation and real growth in the Netherlands.

As a first test, conventional St. Louis equations, that take into account the openness of the Dutch economy, are estimated. Causality tests, in which short-run effects and deviations from long-run equilibrium are included, provide additional evidence on the indicator properties of simple-sum and Divisia aggregates. Because of the importance of the short-term interest rate for the stabilisation of the exchange rate of the guilder to the German mark, the interest rate is included as a potential monetary indicator as well. Finally, out-of sample forecasts are used to test the relative stability of the different money measures.

Only over the EMS period do all monetary aggregates, except sum M2, show a significant impact on inflation. Divisia growth rates tend to outperform their simple-sum equivalents as indicators of real growth and inflation. The results for the EMS period suggest that the short term interest rate may be the preferred inflation indicator in the Netherlands. Additionally, Divisia M3 could be monitored as well because of its relevance for inflation and especially real growth. In addition, Divisia M3 has the overall best performance in forecasting inflation out-of-sample. The results suggest that Divisia M3's velocity has been more stable than sum M3's velocity since 1979.

Overall, the evidence in chapter 6 is in favour of using Divisia aggregates as indicators of inflation and real growth, although not as strongly as might theoretically be expected. Especially at the harmonised M3 aggregation level, it appears that the Divisia money measure generally has better indicator properties for inflation and real income growth than its simple-sum counterpart. One explanation for the observation that Divisia indices do not consistently dominate their simple-sum equivalents is the low and gradual degree of financial innovation in the Netherlands. When the speed of financial innovation increases, the advantages of Divisia aggregates may become clearer. Although the evidence in favour of one of the two aggregation methods is mixed, we do observe that monetary aggregates have become more informative about future inflation, in particular in the period 1979-1993, than was the case in the period from 1965 onwards. This may be due to the increased importance attached to price stability since the late seventies.

Because the Dutch central bank has been targeting the exchange rate with Germany during the seventies and eighties to ensure price stability, chapter 7 analyses whether German simple-sum and Divisia indices of money are potential indicators of Dutch inflation or real growth. The results show that German aggregates contain additional information about real growth, inflation and interest rates in the Netherlands. In contrast to the evidence with Dutch aggregates, German simple-sum aggregates dominate their Divisia counterparts as indicators of Dutch inflation. Chapter 7 also shows that the information content of Dutch and German aggregates for the Dutch economy is quite similar. This outcome is probably due to the exchange rate policy of the Dutch central bank which in effect makes the Dutch money supply an

endogenous variable closely responding to developments in German monetary conditions.

In conclusion, we can state that a theoretically correct definition of the flow of monetary services in the Netherlands is clearly provided by Divisia aggregates. Their relevance for monetary policy is, however, not as evident as theory suggests, since the empirical advantages of Divisia aggregates over simple-sum aggregates are relatively small in terms of their usefulness as indicators of inflation and real growth. Nevertheless, it may be appropriate to use Divisia monetary aggregates (and Divisia M3 in particular) as additional indicators in monetary policy, since these money measures can easily deal with changes in the characteristics of financial assets, which are likely to occur at higher frequencies in the future. Furthermore, since Divisia aggregates are designed to measure transactions money in the economy, these indices should, at least in the longer run, be closely related to nominal spending.

8.2 Directions for future research

The advantages of weighted monetary aggregates as opposed to simple-sum aggregates may, however, still be underestimated due to misspecification of these weighted measures of money. Future research into the substitution between financial assets may be directed at finding a better measure of the assets' user costs. The rental prices used in this thesis are constructed taking into account only the return side of financial assets, computing the rental price as the difference between two interest rates. Recently, however, holders of several financial assets have been confronted with the imputation of bank charges on the use of these assets. An example of this tendency is the charge on the use of checks if more than a specified number of checks are drawn on a demand deposit. Another important, but unresolved, problem in this direction of research concerns the modelling of the dynamics in asset demand systems. How should we incorporate adjustment costs in a portfolio model of an optimizing economic agent? Our dynamic formulation of the Fourier demand system in chapter 5 is an attempt to shed more light on this issue.

Other directions of possibly fruitful further analysis concern the inclusion of the effects of technological progress on different financial assets. The approach by Ford et al. (1992) seems a promising first step in this direction. The effects of technological improvements on financial assets are important for both the substitutability issue between assets and for the correct determination of the flow of monetary services.

As our sectoral analysis in chapter 5 shows, portfolio behaviour of the business sector is clearly different from that of households. Since the subject of the correct measurement of monetary services is founded in microeconomic behaviour of economic agents, a sectoral analysis may be used to construct sectoral money indices and, as such, to improve the quality of the existing weighted aggregates.

Finally, future research could try to integrate the demand and the supply side of the market for monetary services in order to improve monetary authorities' control opportunities of inflation (see Barnett, Hinich and Weber, 1986 and Hancock, 1987).

SAMENVATTING

Het uitgangspunt van dit proefschrift is dat geld de economische ontwikkeling in een land kan beïnvloeden. De huidige macroeconomische theorie erkent dat schokken in het geldaanbod belangrijke fluctuaties in de conjunctuurcyclus veroorzaken en dat een excessieve groei van de geldhoeveelheid op termijn tot inflatie leidt. Sinds de jaren '70 zijn centrale banken in veel geïndustrialiseerde landen overgegaan op een beleid van doelzones voor de groei van monetaire aggregaten om zodoende hun uiteindelijke doelstelling van prijsstabiliteit te bereiken. Instabiliteiten in de vraag naar geld in de jaren '70 en '80 hebben er toe geleid dat veel centrale banken deze beleidslijn in de afgelopen jaren weer hebben verlaten. Tegenwoordig houdt monetaire politiek veelal in dat centrale banken de korte termijn interestvoet veranderen en door middel van directe doelzones de inflatie trachten te bestrijden.

In dit proefschrift wordt voor Nederland onderzocht of instabiliteiten in de vraag naar de traditionele monetaire aggregaten zijn veroorzaakt door fouten in de afbakening van het geldbegrip. Substitueerbaarheid tussen de componenten van monetaire aggregaten en andere liquide financiële activa kan een belangrijke bron van meetfouten vormen. Een dergelijke substitutie beïnvloedt de correcte definitie van het geldbegrip en bovendien de (stabiliteit van de) vraag naar monetaire aggregaten. Bovendien wordt de bruikbaarheid van monetaire aggregaten als indicator voor monetaire politiek door substitutie beïnvloed. Genoemde meetfouten komen in het bijzonder tot uitdrukking in de traditionele ongewogen (sommatie) aggregaten. Deze laatste aggregatiemethode veronderstelt dat de componenten van monetaire aggregaten perfecte substituten zijn en dat er geen substitutie naar andere financiële activa (buiten de aggregaten) optreedt. De praktijk komt slechts zelden met deze veronderstellingen overeen, aangezien het publiek tegenwoordig over een heel spectrum van financiële activa met uiteenlopende kenmerken kan beschikken.

Het belang van meetfouten voor instabiliteiten in de vraag naar sommatie aggregaten wordt op twee manieren geanalyseerd. In de eerste plaats wordt in deze studie onderzocht hoe een theoretisch correcte definitie van de monetaire dienstenstroom in een economie kan worden geconstrueerd. In de tweede plaats wordt nagegaan of een dergelijke correcte geldmaatstaf een bruikbare indicator voor de Nederlandse economische situatie vormt. Daarbij kan het verschil in bruikbaarheid van de sommatie en de gewogen monetaire aggregaten als indicatoren voor monetair beleid worden geïnterpreteerd als een indicatie voor de relatieve stabiliteit van de vraag naar deze aggregaten.

Het proefschrift toont aan dat een correcte maatstaf voor de monetaire dienstenstroom in een economie (monetaire aggregaten zouden in feite deze stroom moeten meten) gebaseerd dient te zijn op microeconomische principes en op de theorie van indexcijfers. Hoofdstuk 2 geeft een overzicht van de internationale empirische literatuur over de meting van monetaire diensten. Uit dit overzicht blijkt dat de (ongewogen) monetaire aggregaten die worden gebruikt voor beleidsdoeleinden niet voldoen

aan de genoemde theoretische uitgangspunten. De componenten van deze aggregaten zijn imperfecte substituten of zelfs elkaars complement.

In hoofdstuk 3 wordt de microeconomische theorie omtrent consistente aggregatie gedetailleerd besproken. Aggregaten van goederen of financiële activa gedragen zich als één goed indien preferenties over de afzonderlijke componenten onafhankelijk zijn van de consumptie van andere goederen of activa. Dergelijke aggregaten worden zwak scheidbaar genoemd. Uit het empirische gedeelte van dit hoofdstuk blijkt dat de Nederlandse monetaire aggregaten M1 en M3 zwak scheidbaar zijn van de consumptie van goederen en van andere financiële activa. De gebruikte niet-parametrische toets geeft echter aan, dat M2 zich niet geheel conform de microeconomische vraagtheorie gedraagt.

Hoofdstuk 4 behandelt de theorie van de indexcijfers en enkele aspecten van de microeconomische theorie die noodzakelijk zijn om de correcte aggregatiemethode over de componenten van (zwak scheidbare) monetaire aggregaten te bepalen. Monetaire aggregaten dienen de liquiditeit (m.a.w. de monetaire dienstenstroom) in een economie te meten, aangezien liquiditeit een belangrijke determinant van bestedingen en inflatie vormt. Een geschikt monetair aggregaat dient rekening te houden met de verschillen in liquiditeit tussen financiële activa. Ongewogen sommatie aggregaten beschouwen alle elementen als perfecte substituten met dezelfde mate van liquiditeit. Een benadering voor de mate van liquiditeit van financiële activa wordt gevormd door de alternatieve interestkosten die mensen maken als ze hun vermogen in liquide vorm aanhouden. Derhalve zijn gewogen aggregaten wel in overeenstemming met de microeconomische uitgangspunten. Een dergelijk gewogen aggregaat is het Divisia aggregaat, dat elke onbekende nutsfunctie over een aantal financiële activa kan benaderen. De empirische analyse in hoofdstuk 4 geeft aan dat Divisia aggregaten pure substitutie-effecten tussen hun componenten goed kunnen internaliseren.

In hoofdstuk 5 wordt onderzocht of de belangrijkste elementen van het Nederlandse geharmoniseerde M3 geldbegrip (chartaal geld, giraal geld, kortlopende termijndeposito's en kortlopende spaartegoeden) dezelfde mate van liquiditeit bezitten. Dit gebeurt door substitutie-elasticiteiten tussen de financiële activa te schatten. De onbekende nutsfunctie (of aggregatiefunctie) over deze financiële activa wordt benaderd door 3 functionele vormen: de statische en de dynamische Fourier specificatie en de translog specificatie. De analyse wordt zowel uitgevoerd voor de gehele Nederlandse economie als voor bedrijven en gezinnen afzonderlijk. Substitutierelaties tussen de componenten van M3 overheersen, op geaggregeerd en op sectoraal niveau, hoewel enkele combinaties van activa complementen blijken.

De geschatte tijdreeksen van substitutie-elasticiteiten blijken redelijk stabiel over de periode 1972-1993. De hypothese van perfecte substitutie tussen de componenten van het geharmoniseerde M3 geldbegrip dient echter te worden verworpen. Voorts bestaan er aanzienlijke verschillen in portefeuillegedrag van bedrijven en gezinnen. Ongewogen sommatie over de componenten van M3 geeft dan ook geen correct beeld van de monetaire dienstenstroom in de Nederlandse economie.

In hoofdstuk 6 worden de resultaten van een empirisch onderzoek naar de indicatoreigenschappen van ongewogen en Divisia monetaire aggregaten in Nederland besproken. Onderzocht wordt in hoeverre ongewogen en Divisia aggregaten kunnen

fungeren als indicatoren voor inflatie en reële groei in Nederland. Hierbij worden St. Louis vergelijkingen en causaliteitstoetsen gebruikt, zodat de korte en de lange termijn effecten van geldgroei op inflatie en reële groei kunnen worden geanalyseerd. Sinds het begin van het EMS blijken alle monetaire aggregaten, behalve het ongewogen M2 aggregaat, een significante invloed op de inflatie uit te oefenen. Groei in de Divisia aggregaten blijkt een betere voorspelling op te leveren van inflatie en reële groei in Nederland dan groei in de ongewogen aggregaten. Het Divisia M3 aggregaat levert de beste voorspelkracht op voor inflatie.

De resultaten wat betreft de indicatoreigenschappen van ongewogen en Divisia aggregaten zijn niet zo duidelijk in het voordeel van Divisia aggregaten als theoretisch is te verwachten. Een verklaring hiervoor zou het lage innovatietempo in het Nederlandse financiële systeem kunnen zijn.

Hoofdstuk 7 bevat een vergelijkbare analyse als hoofdstuk 6, maar nu worden de indicatoreigenschappen van Duitse ongewogen en Divisia monetaire aggregaten voor de Nederlandse inflatie en reële groei onderzocht. De reden voor deze analyse is dat het beleid van De Nederlandsche Bank er sinds de jaren '70 op gericht is geweest de wisselkoers tussen de gulden en de DM te stabiliseren. Uit de analyse van hoofdstuk 7 blijkt dat Duitse en Nederlandse monetaire aggregaten vergelijkbare informatie bevatten over Nederlandse inflatie en reële groei.

De conclusie van dit proefschrift luidt dat Divisia monetaire aggregaten tot een theoretisch correcte definitie van de monetaire dienstenstroom in Nederland leiden. Het belang van Divisia aggregaten voor het Nederlandse monetaire beleid is echter nog niet zo groot, aangezien de empirische voordelen van Divisia aggregaten als indicator voor inflatie en/of reële groei vooralsnog beperkt zijn.